

**RESULTS OF THE FEBRUARY 11, 2009  
UTAH GROUND-SHAKING WORKING GROUP MEETING**

Members:

Ivan Wong  
Mark Petersen  
Bill Stephenson  
Jerry Schuster  
Walter Arabasz  
Greg McDonald  
Harold Magistrale  
Kris Pankow  
Jim Pechmann  
Jim Bay  
Kim Olsen  
Daniel Roton

Guests:

Gary Christenson  
Steve Harmsen  
Steven Bartlett  
Mike Olsen  
Tyler Knudsen  
Travis Gerber  
Jamie Farrell  
Chris DuRoss  
Mike Hylland  
Christine Puskas  
Les Youd  
Eleanor Sonley  
Steve Bowman

**MEETING SUMMARY**

The meeting was convened at 1:00 by Ivan Wong and Greg McDonald. Introductions of the attending members and guests were performed. Wong gave a brief overview of the purpose of the meeting and reviewed the goals of the working group. The following short technical presentations were made:

**Ivan Wong - Update on National Earthquake Hazards Reduction Program (NEHRP) grant “Inversion for source, path, and site parameters from the Wasatch Front Advanced National Seismic System (ANSS) data”**

The purpose of the study:

- Evaluate critical factors controlling ground-shaking hazard along the Wasatch Front:
  - Earthquake stress drop
  - Kappa
  - Crustal attenuation  $Q(f)$
  - Site amplification factors
- Analyze ANSS strong motion and broadband data using inversion scheme developed from Walt Silva
- Data have been collected, processed, and is currently being inverted for the above factors

## **Harold Magistrale – Update on modifications to Community Velocity Model (CVM) and proposal to expand/update CVM and evaluate Vp/Vs ratios and R2 to R3 gradient**

The CVM, updated with revised site-conditions units and along eastern basin margin (Wasatch fault), has been tested to see how well simulated ground motions using the CVM compare with actual ground motion recordings.

A NEHRP proposal was submitted to the USGS and recommended, but put on hold pending funding of the USGS external budget.

The purpose of the project is to:

- Expand the CVM to include Tooele and Rush Valleys and Wasatch back valleys,
- Update CVM with intermediate-depth data (USGS Utah and Salt Lake Valley seismic surveys (reflection and SPAC))
- Evaluate Vp/Vs ratios
- Evaluate R2 to R3 velocity gradient using available Utah Division of Oil, Gas and Mining sonic logs (presently using hard rock velocities)

## **Daniel Roton/Kim Olsen – Presentation and discussion of Wasatch Front CVM validation; preliminary 1Hz 3-dimensional M 7.0 scenario ground motion maps**

CVM validation

- Three validation events (Lehi, Magna, and Tremonton)
- Moment tensor inversion increases Mw from 3.3 to 3.6
- Synthetic/observed waveform fit is improved by Mw increase and updated CVM for Lehi and Magna events; however, still some aspects of the waveforms cannot be reproduced

Preliminary scenario M 7.0 earthquake model

- Project planar dynamic-rupture models onto 3-D model of Wasatch fault in CVM; incorporated E-W-striking, S-dipping tear fault (Pechmann) connecting Warm Springs to East bench sections (northern end of Salt Lake City segment)
- Modeled ground motions showing strong rupture propagation/directivity effects
- Ground motions from dynamic models are in general lower than pseudo-dynamic
- Misfit of waveform amplifications at stations near hypocenter (wrong source mechanism?)
- 1s-SAs less than finite-fault model (Solomon, 2004)
- M 7.0 scenario results within 16% and 84% percentiles predicted by empirical attenuation relationships (C&B008 and B&A008)
- Need to refine shear-velocity values (e.g. reconsider truncating velocities at 200 m/s)

### **Kris Pankow - Update on Feb 21, 2008 Wells, NV M 6.0 earthquake**

- Portable instruments recorded aftershocks in the near-field (up to M 4.7)
- Ground motions from normal-faulting earthquakes are poorly represented in the ground-motion prediction equations.
- Records from strong-motion stations in Salt Lake Valley suggest peak ground accelerations may be greater than expected

### **Mark Petersen - USGS perspective on Wasatch Front urban hazard maps**

Petersen led a discussion on the path forward to developing the urban hazard maps. A particular issue was the schedule, given the uncertain status of the CVM. Key issues:

- Evaluate the need for formal review
- Assess whether or not validation exercise is complete
- Define areas where model needs improvement
- Propose releasing CVM to different groups of modelers using specified source parameters to get at epistemic uncertainties
- Provide a simple test case with specific parameters to compare model results
- Proposed test case:
  - Kinematic rupture (defined source, slip function, and rupture timing)
  - National Seismic Hazard Maps fault plane
  - Slip distribution (Zeng)
  - Slip function (Brune, Graves – triangular, Liu – beta function)
  - Rupture velocity – 2.5 km/s
  - Hypocenter – North SLC segment rupture to south
  - M - 7.0
  - Dip - 55 deg
  - Depth - 18 km
  - Rake - Normal
- Continue with plans to test dynamic models: Olsen's group, Archuleta's group, and 2 USGS groups model using specific input parameters for comparison of results:
  - Olsen and Pechmann (dynamic and kinematic)
  - Archuleta and Smith (dynamic and kinematic)
  - USGS – Harmsen, Stephenson, Zeng, Hartzell, Petersen, and Ramirez-Guzman (finite element)
- Test Wasatch fault model using SCEC scenario (i.e., need to vet Wasatch Front model against SCEC model)
- Evaluate how dynamic modeling contributes to waveforms
- Assess where additional Vs data may improve CVM for future updates (Jim Bay and Greg McDonald)
- Evaluate gravity-based basin model outside Salt Lake Valley; data may need to be reprocessed

- Ivan Wong – Perform update of Salt Lake basin ground-shaking maps incorporating PEER NGA attenuation relationships and revised site-conditions units

The meeting adjourned at 5:00 pm.

#### References

Solomon, B.J., 2004, Earthquake-hazards scenario for M7 earthquake on the Salt Lake City segment of the Wasatch fault zone, Utah: Utah Geological Survey Special Study 111DM, 59 p., 6 pl. scale 1:50,000.